Original Article

Dual Plating Vs Single Plating in Distal Humerus Fracture: A Retrospective Comparative Study at A Tertiary Care Hospital in Mumbai

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Abstract

Background: Distal humerus fractures present surgical challenges due to complex anatomy and the need for stable fixation for early mobilization. Dual plating is traditionally preferred for biomechanical stability, but single plating with locking plates is emerging as a less invasive alternative. This study compared clinical, radiological, and functional outcomes of dual versus single plating in a tertiary care setting in Mumbai. **Material and Methods:** This retrospective comparative study included 48 adults (18–65 years) with distal humerus fractures (AO types A2, A3, C1–C2) treated over one year. Patients were divided into dual plating (n=24) and single plating (n=24) groups. Outcomes assessed included operative time, blood loss, union rates, complications, and functional scores (MEPS, DASH) at up to 12 months. Statistical analysis was performed using SPSS v25 with $p<0.05$ considered significant. **Results:** The mean age was comparable between groups, with a male predominance and road traffic accidents as the primary cause (75%). Dual plating had significantly longer operative time (102 ± 18 vs 63 ± 14 minutes, $p<0.001$) and higher blood loss (285 ± 65 vs 165 ± 48 ml, $p<0.01$). Union rates were similar (95.8% vs 91.7%, $p=0.55$), with comparable time to union. Functional outcomes were also similar, with good-to-excellent MEPS in 83.3% (dual) and 79.2% (single) ($p=0.72$), and comparable DASH scores. Complications were more frequent in the dual plating group, though not statistically significant. **Conclusion:** Both techniques provided satisfactory outcomes. Single plating offered advantages of reduced operative time and blood loss with comparable functional results, suggesting it as a viable option in selected cases.

Keywords: Distal humerus fracture, dual plating, single plating, ORIF, MEPS, functional outcome, Mumbai study.

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Introduction

Distal humerus fractures account for approximately 2–6% of adult fractures and remain challenging due to complex anatomy, articular involvement, and proximity to neurovascular structures. They commonly result from high-energy trauma in younger individuals and low-energy falls in the elderly, with intra-articular comminution seen in more than half of cases. Inadequate fixation may lead to stiffness, nonunion, or malunion, significantly affecting elbow function. Open reduction and internal fixation (ORIF) is the current standard of care, enabling anatomical reduction and early mobilization.[1,2]

Dual plating, either in orthogonal (90–90) or parallel configurations, is widely accepted for providing multiplanar stability, particularly in comminuted (C-type) fractures. Biomechanical studies support its superior resistance to varus and torsional forces. However, single-column plating with anatomically contoured locking plates has emerged as a less invasive alternative, potentially reducing soft-tissue dissection, operative time, and complications such as heterotopic ossification and ulnar nerve irritation. Recent evidence suggests comparable union rates between the two techniques, though dual plating may be associated with higher complication rates.[3,4]

Indian studies report favorable outcomes with dual plating, particularly in AO type C fractures, with high functional scores. However, comparative data between single and dual plating in urban Indian populations remain limited. This study evaluates both techniques in a tertiary care hospital in Mumbai, focusing on operative parameters, union rates, functional outcomes, and complications. It aims to provide context-specific evidence to support surgical decision-making in high-volume trauma settings where minimizing surgical morbidity is essential.

Materials and Methods

This retrospective study reviewed patients with distal humerus fractures managed surgically at a tertiary care teaching hospital in Mumbai over one year. Institutional ethics committee approval

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was obtained prior to data collection, and the study adhered to the Declaration of Helsinki. All participants or their legal guardians provided written informed consent for surgery and data usage. No conflicts of interest were declared by the investigators.

Patients aged 18–65 years with AO/OTA classified distal humerus fractures (primarily A2, A3, C1, C2) who underwent ORIF with either single or dual locking plate fixation were included. The choice of plating was based on surgeon preference and fracture pattern, with dual plating typically reserved for more comminuted or intra-articular cases. Exclusion criteria comprised pathological fractures, Gustilo-Anderson grade II/III open injuries, severe osteoporosis, pre-existing elbow pathology, associated major upper limb injuries, or incomplete follow-up data.

Surgical technique involved posterior approach with or without olecranon osteotomy for articular exposure. Dual plating used medial and lateral/ posterolateral pre-contoured locking compression plates in orthogonal or parallel fashion, while single plating employed a posterolateral or medial anatomical locking plate with adequate screw purchase. Intraoperative fluoroscopy ensured anatomic reduction. Postoperative protocol included immobilization for 7–10 days followed by gradual mobilization under physiotherapy guidance. Intravenous antibiotics were administered for 48 hours, with thromboprophylaxis as per institutional protocol.

Data were collected from hospital records, including demographics, injury mechanism, time to surgery, operative duration, blood loss, union time (defined as bridging callus on radiographs in two planes without pain), complications (infection, nonunion, stiffness, implant issues), and functional assessment using MEPS and DASH scores at final follow-up (minimum 12 months). Radiological evaluation was performed by independent observers. Statistical analysis was conducted using SPSS version 25.0. Continuous variables were expressed as mean ± SD and compared with Student's t-test or Mann-Whitney U test; categorical data with chi-square or Fisher's exact test. A p-value <0.05 was considered statistically significant. Power analysis indicated adequate sample for detecting differences in operative time and MEPS.

Results

A total of 48 patients met the inclusion criteria, with 24 in each group (dual plating and single plating). Baseline characteristics were comparable: mean age 42.3 ± 11.7 years in dual vs 44.1 ± 12.4 in single (p=0.58), male:female ratio 15:9 vs 16:8. Road traffic accidents were the predominant mode (75%), followed by falls. AO classification showed a mix, with C1/C2 more common in dual group.

Table 1: Demographic and Injury Characteristics

Parameter	Dual Plating (n=24)	Single Plating (n=24)	p-value
Age (mean ± SD, years)	42.3 ± 11.7	44.1 ± 12.4	0.58
Male (%)	62.5	66.7	0.76
RTA (%)	79.2	70.8	0.51
AO Type C (%)	58.3	45.8	0.39

Table 2: Operative Parameters

Parameter	Dual (mean ± SD)	Single (mean ± SD)	p-value
Surgery time (min)	102 ± 18	63 ± 14	<0.001
Blood loss (ml)	285 ± 65	165 ± 48	<0.01
Hospital stay (days)	5.2 ± 1.4	4.1 ± 1.1	0.03

Union was achieved in 23/24 (95.8%) dual and 22/24 (91.7%) single cases, with mean time 12.4 vs 13.1 weeks (p=0.48). Functional outcomes at 12 months were similar.

Table 3: Functional Outcomes at 12 Months

Score	Dual (mean ± SD)	Single (mean ± SD)	p-value
MEPS	85.6 ± 9.2	83.4 ± 10.1	0.45
DASH	14.2 ± 6.8	16.5 ± 7.9	0.31
Excellent/Good MEPS (%)	83.3	79.2	0.72

Table 4: Complications

Complication	Dual n (%)	Single n (%)	p-value
Overall complications	5 (20.8)	2 (8.3)	0.22
Stiffness (>20° loss)	3 (12.5)	1 (4.2)	0.3
Infection (superficial)	1 (4.2)	1 (4.2)	1
Nonunion	1 (4.2)	2 (8.3)	0.55
Implant prominence	2 (8.3)	0	0.15

No cases of deep infection, nerve palsy persistence, or revision for hardware failure were noted in either group. Most patients returned to pre-injury activities by 6–9 months.

Discussion

Distal humerus fractures demand robust fixation to restore elbow kinematics and prevent long-term disability. This Mumbai-based study over one year compared dual versus single plating, reflecting real-world trauma practice in a high-volume Indian center. Overall, both techniques yielded satisfactory union rates and functional recovery, aligning with global trends where modern locking plates minimize traditional complications.[5,6]

Operative time and blood loss were markedly lower with single plating, consistent with Agarwal et al. (2024), who reported 103 min vs 62 min and greater blood loss in dual plating for extra-

articular distal humerus fractures. Mao et al. (2022) similarly noted higher complications (18.75% vs 5.56%) with double plating in distal humerus cases, attributing this to increased soft-tissue disruption. Our findings echo these, suggesting single plating as a viable option for less comminuted patterns to reduce perioperative morbidity in resource-constrained settings.[7,8]

Union rates and time were comparable between groups, supporting the meta-analysis by Baumann et al. (2025), which found no significant difference in nonunion risk (5.0% dual vs 7.3% single) across 788 humerus fractures, including distal subsets. Indian studies, such as Verma et al. (2022) on single extra-articular plating versus bipillar, and Sharma et al. on orthogonal dual plating, reported union in >90% with MEPS around 80–85, mirroring our 83% excellent/good outcomes. International data from Kurk et al. (2025) highlighted longer union in orthogonal dual plating, especially in osteopenic bone, whereas parallel or single constructs performed consistently.[9,10]

Functional scores (MEPS and DASH) showed no statistical difference, with both groups achieving good-to-excellent results in over 79%. This parallels findings from Nathi et al. (2023) on orthogonal dual plating and Chitnavis et al. (2024) using pre-contoured plates, where MEPS exceeded 80 in Indian cohorts. Single plating-maintained stability without increased implant failure, as seen in Scolaro et al. (2014) biomechanical work favoring single posterolateral for certain extra-articular patterns. Our slightly higher (non-significant) complications in dual plating, mainly stiffness and prominence, align with reports of increased soft-tissue issues in bicolumnar fixation.[11,12]

For range of motion and stability, dual plating theoretically offers advantages in complex C3 fractures, yet our selected cohort (mostly C1-C2) demonstrated equivalence, consistent with Bahroun et al. (2024) comparing orthogonal vs parallel double plates. In osteoporotic or elderly subsets (common in Mumbai trauma), single plating may suffice with locking screws, reducing operative burden as per Western series like Gaston et al. (2024) on humeral fractures.[13,14]

Limitations of this study include its retrospective design, modest sample size from a single center, and potential selection bias in plating choice. Follow-up was limited to 12 months, precluding long-term arthritis assessment. Future multicenter prospective randomized trials in Indian populations are recommended to validate these observations.

Conclusion

In this one-year study, single plating for distal humerus fractures offered shorter operative time, less blood loss, and comparable union rates and functional outcomes (MEPS ~84, low DASH) to dual plating, with a trend toward fewer complications. Both methods achieved reliable fixation and good-to-excellent recovery in most patients, supporting tailored use based on fracture complexity—single plating for simpler patterns to minimize morbidity, and dual for highly unstable cases. These findings add to growing evidence favoring fewer invasive options in modern plating systems and underscore the importance of surgeon experience and early rehabilitation. Larger studies could further refine indications, ultimately enhancing patient-centered care.

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Conflicts of interest

There are no conflicts of interest.

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